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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

**FOOD STANDARDS COMMITTEE
REPORT ON FLUORINE**

**Revised Recommendations for limits for
fluorine content of foods**

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FOOD STANDARDS COMMITTEE

The Food Standards Committee was appointed by the Minister of Food in 1947 with the following terms of reference:

To advise the Ministers of Food and Health and the Secretary of State for Scotland as to the provision to be made concerning the composition of foods (other than liquid milk) and the labelling or marking of any foods for which such provision is made, by:

(a) Statutory Orders under the Defence (Sale of Food) Regulations; or
(b) Regulations (other than Milk and Dairies Regulations) under the Food and Drugs Acts, and corresponding enactments relating to Scotland; for preventing danger to health, loss of nutritional value or otherwise protecting purchasers.

The members of the Food Standards Committee are:

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METALLIC CONTAMINATION SUB-COMMITTEE

The Metallic Contamination Sub-Committee was appointed by the Food Standards Committee in October, 1948, with the following terms of reference:

A. To consider the available evidence in regard to:

- (i) The effect of the ingestion of foods contaminated with metals or other injurious elements.
- (ii) The technological problems which might arise from the prescription of limits for such contamination.

B. To advise:

Where the evidence is sufficient to justify the recommendation of limits for any metals or other injurious elements, what these limits should be and whether they should be applied to foods generally, to any particular food or group of foods.

C. Generally to make proposals which may assist the Food Standards Committee to make recommendations, or to institute any further investigations which may be required.

The following served on the Metallic Contamination Sub-Committee during the preparation of this report:

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FOOD STANDARDS COMMITTEE

REPORT ON FLUORINE

Revised Recommendations for Limits for Fluorine Content of Foods

In February, 1953, the Food Standards Committee received a Report from their Metallic Contamination Sub-Committee recommending modification of the limits for the fluorine content of acidic phosphates and related foods laid down in the Fluorine in Food Order, 1947. The Report has since been revised in the light of representations received from trade and other interests. The Revised Report which has been adopted by the Food Standards Committee is in the following terms:—

1. Fluorine is found in the bones and teeth of man and animals in amounts which usually increase with age. The normal range of fluorine content of the bones of land mammals has been estimated at 100 to 1,000 p.p.m., or more, and in man from 200 p.p.m. to 800 p.p.m. The fluorine content of teeth is less than that of bones and is lower in the enamel than in the dentine.
2. There is considerable evidence that the drinking of water containing about 1 p.p.m. fluorine is accompanied by a reduction in the incidence of dental caries. On the other hand, the drinking of water containing 2 p.p.m. or more fluorine often gives rise to small white flecks in the tooth enamel. With further increases in the fluorine content of water this flecking is yet more frequent, and brown staining of the teeth is also seen. The ingestion of fluorine in large amounts may lead to overgrowth and brittleness of the bones and calcification of ligaments and tendons, which in extreme cases may cause immobility and death in animals and severe malformation in man.
3. In May, 1946, the Inter-Departmental Committee on Food Standards published a report on the question of prescribing limits to the fluorine content of acid phosphates used for food purposes. The Committee stated that on the evidence then available it was only possible to make an approximate estimate of the maximum amount of fluorine which could be ingested daily over a period of years without harmful effect. At that time a small but indispensable part of the acid calcium phosphate used for food purposes was manufactured from rock phosphate highly contaminated with fluorine. The Medical Research Council, who were consulted by the Committee, pointed out that the safest procedure would have been to prohibit the use of calcium acid phosphate (A.C.P.) made from rock phosphate for food purposes, but, having regard to the supply position at that time and to the small proportion of A.C.P. which is used in such foods as self-raising flour, they considered that a limit of 300 p.p.m. of fluorine in A.C.P. would be safe.
4. The Fluorine in Food Order, 1947, embodied the Committee's recommendations, and set the following limits to the fluorine content of acid phosphates used in the manufacture of food and of baking powders and self-raising flour:

<i>Articles of Food</i>	<i>Maximum Fluorine Content</i>
(i) Calcium acid phosphate, sodium acid pyrophosphate or any other acidic phosphate	300 parts per million

- (ii) Any article of food (not included in items (iii) and (iv) below) containing calcium acid phosphate, sodium acid pyrophosphate or any other acidic phosphate and intended for use in the composition or preparation of food
 - 300 parts per million parts of the calcium acid phosphate, sodium acid pyrophosphate or other acidic phosphate present
- (iii) Baking powders, including golden raising powder
 - (a) 100 parts per million parts of the article of food where such article yields less than 15 per cent of available carbon dioxide
 - (b) 133 parts per million parts of the article of food where such article yields not less than 15 per cent of available carbon dioxide
 - 8 parts per million parts of the article of food
- (iv) Self-raising flour or any similar mixture (not included in item (iii) above) containing a farinaceous substance and an acidic phosphate

5. The literature on fluorosis is very extensive and we cannot do more than summarise a few of the investigations which have a bearing on the question of prescribing limits to the fluorine content of foods.

6. It appears that, in general, drinking waters provide the principal source of dietary fluorine and that the majority of foods found in the average diet only contain from 0.2 – 0.3 p.p.m. or less fluorine in the food as consumed. There are, however, one or two notable exceptions. Acid calcium phosphate produced from rock phosphate has been referred to above. Apart from this it has been found that tea may contain up to 100 p.p.m. fluorine in the dry tea, whilst shellfish may contain 5 – 15 p.p.m. fluorine.

7. An enquiry into the urinary excretion of fluorine in some New Zealand subjects showed that tea is a major source of fluorine in New Zealand where the water supplies contain only a small quantity of this element (of the order of 0.05—0.3 p.p.m.); the tea used in this enquiry had a fluorine content of 68 p.p.m. corresponding to an average daily intake of fluorine of about 0.42 mg., an amount well below the level at which toxic fluorosis could occur.

8. Fluorine balances after the addition of supplements of fluorine to the food and drinking water of a few young men were the subject of enquiry in 1945. The results showed that about 4 mg. of fluorine could be absorbed daily by healthy persons without appreciable risk, and that urine and sweat were the chief avenues for the elimination of fluorine.

9. The hazard to man and animals arising from exposure to fluorine compounds emanating from factories manufacturing aluminium near Fort William, Scotland, was the subject of a report issued in 1949. Some of the older workmen who had inhaled fluorine for a large number of years showed bone changes of the type generally recognised to be produced by fluorosis, but none of the workers suffered clinical disability. Sheep and cattle grazing near the factories suffered from gross deformity of the teeth and jawbone which made mastication difficult or impossible and led to inanition.

10. A paper published in 1948 discussed the occurrence of fluorosis in farm animals arising from industrial contamination of pasture in connection with the manufacture of bricks in Bedfordshire, the calcining of ironstone in Lincolnshire and the fumes from a colour and enamel factory in Staffordshire. It was

shown that the contamination of vegetation was entirely superficial and not due to fluorine compounds carried down into the soil by rain. The authors record their general impression that the hazard to people living in these areas was negligible and that the problems of aerial contamination were entirely different in veterinary and human medicine, mainly because with farm stock the source of danger is grass and hay, which may be heavily contaminated, and no ill effects have as yet been attributed to inhalation. With the human subject on the farm the dietary risk is confined to exposed outer leaves of vegetables which are either discarded or washed and in any case form a very small part of the total food intake. On the other hand, they point out that in view of the longer span of the life of a man small skeletal changes over long periods of time may be significant.

11. The problems connected with fluorine in drinking water are under continual examination by the Ministry of Health. The relatively high fluorine content of shellfish can be ascribed to the fluorine content of the sea which is of the order of 1 p.p.m. and is of natural occurrence. The New Zealand enquiry suggests that the drinking of tea is not likely in itself to give rise to the absorption of fluorine in quantities which could cause toxic effects.

12. We are accordingly led to the conclusion that the only point which arises for our consideration is whether the limits of fluorine in acid phosphates and related foods laid down in the Fluorine in Food Order, 1947, call for revision. It has been observed that allowing for a maximum daily consumption of about 100 g. self-raising flour or an equivalent quantity of baking powder these limits would imply the addition of 0.8 mg. of fluorine to the daily diet and that this quantity, taken in solid food, is not by itself objectionable. On the other hand, if the present limits are higher than are required in good commercial practice there is no advantage in perpetuating them.

13. We are informed that the manufacture of acid calcium phosphate from rock phosphate is no longer a necessary part of the supply for food. Acid sodium pyrophosphate can normally be produced with a fluorine content of less than 5 p.p.m. but this figure is exceeded in acid calcium phosphate because of the fluorine content of the lime. Tests carried out by the manufacturers have shown that the fluorine content of acid calcium phosphate would rarely exceed a figure of 27 p.p.m.

14. We feel that with reasonable precautions the fluorine content of acid calcium phosphate produced from elemental phosphorus can be kept within a limit of 30 p.p.m. This figure is already enforced in the Canadian Food and Drug Regulations, and we recommend that it should be adopted in this country also.

15. The acid calcium phosphate content of baking powder increases according to the strength of the powder, i.e. the available CO_2 . Baking powder for domestic use is manufactured to a strength varying from 10.5 per cent to 12 per cent, but for canteen and catering supplies 15 per cent available CO_2 is quite normal, and in the baking industry the figure of available CO_2 may be 17.5 per cent. On the assumption that the acidic phosphate contains 30 p.p.m. fluorine, the fluorine content of baking powder manufactured to a strength of 12 per cent available CO_2 may be as high as 11.15 p.p.m. We consider, therefore, that some modification of our original proposal to apply a limit of 10 p.p.m. fluorine to baking powder is called for; and we now recommend a limit of 15 p.p.m. fluorine for baking powder, including golden raising powder.

16. In considering the limit for self-raising flour allowance must be made for fluorine which may be contributed by the flour and by creta praeparata, and for the difficulty of ensuring a uniform distribution of creta praeparata in flour. For self-raising flours, therefore, we recommend a limit for fluorine of 3 p.p.m.

17. We therefore recommend that the Fluorine in Food Order, 1947, should be amended so as to set the following limits to the fluorine content of acidic phosphates intended for use in foods and of foods containing acidic phosphates:

<i>Articles of Food</i>	<i>Maximum Fluorine Content</i>
(i) Acidic phosphates	30 p.p.m.
(ii) Any article of food (not included in items (iii) and (iv) below) containing acidic phosphates and intended for use in the composition or preparation of food	30 p.p.m. of the acidic phosphates present
(iii) Baking powder, including golden raising powder	15 p.p.m.
(iv) Self-raising flour or any similar mixtures (not included in item (iii) above) containing a farinaceous substance and an acidic phosphate.	3 p.p.m.

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